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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,881	11/21/2003	Yi-Lung Cheng	TS03-431	1465

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EXAMINER	
NGUYEN, THANH T	
ART UNIT	**PAPER NUMBER**
2813	

DATE MAILED: 05/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/718,881	CHENG ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *14-23* is/are allowed.

6)☒ Claim(s) *1,2,4-13,24,25,27 and 28* is/are rejected.

7)☒ Claim(s) *3, 26* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/17/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

The information disclosure statement filed on 2/17/04 has been considered.

Oath/Declaration

Oath/Declaration filed on 11/21/03 has been considered.

Specification

The disclosure is objected to because of the following informalities: there is a typographical in the specification as well as the claims, the formula of "hydro - silicon oxynitride (HOxSiN)" should be replace with "hydro - silicon oxynitride (SiOxNH)".

In the specification as well as claims 3-5, 13-14, 16, 23, 26 are objected because there is a typographical error "an underlying silicon rich, silicon oxide layer" should be replace with "an underlying silicon rich-silicon oxide layer".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 4-7 recite the limitation "wherein an underlying silicon rich, silicon oxide layer of said tri-layer insulator composite" in claims 4-5, "wherein a hydro-silicon oxynitride (HOxSN) layer of said tri-layer insulator composite in claim 6, "wherein a silicon nitride layer of said tri-layer insulator composite" in claim 7, "wherein a silicon nitride layer component of said tri-layer insulator composite" in claim 12, and "wherein said silicon rich, silicon oxide layer of said tri-layer insulator composite" in claim 13. There is insufficient antecedent basis for this limitation in the claim. It is suggested to change the dependency of claims 4-7 to depend on claim 3 instead of claim 1.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2 are rejected under 35 U.S.C. 102(b) as being anticipated by Islam et al. (U.S. Patent No. 6,174,810).

Referring to figures 1-6, Islam et al. teaches a method of defining an opening in a stack of insulator layers on a semiconductor substrate, comprising the steps of:

providing a conductive region (38) on said semiconductor substrate (10);

forming a tri-layer insulator composite (40/41/42; silicon nitride/silicon oxynitride/oxide) on said conductive region and on portions of said semiconductor substrate (see figure 4);

forming an insulator layer (46, TEOS/BPSG, see col. 5, lines 43-47) on said tri-layer insulator composite;

forming an opening (52) in said insulator layer to expose a portion of a top surface of said tri-layer insulator composite (see figure 5); and

removing portion of said tri-layer insulator composite (52) exposed in said opening (see figure 6);

exposing a portion of a top surface of said conductive region (see figure 6).

Regarding to claim 2, the conductive region is a source/drain region in a semiconductor substrate, or a metal structure such as a metal interconnect structure (38, see figure 6).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4-13, 24-25, 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Islam et al. (U.S. Patent No. 6,174,810) as applied to claims 1-2 above in view of Wolf et al. (Silicon Processing for the VLSI ERA, vol. 1, pages 182-195, 551-555, 581-582).

Referring to figures 1-6, Islam et al. teaches a method of defining an opening in a stack of insulator layers on a semiconductor substrate, comprising the steps of:

providing a conductive region (38) on said semiconductor substrate (10);

forming a tri-layer insulator composite (40/41/42; silicon nitride/silicon oxynitride/oxide) on said conductive region and on portions of said semiconductor substrate (see figure 4);

forming an insulator layer (46, TEOS/BPSG, see col. 5, lines 43-47) on said tri-layer insulator composite;

forming an opening (52) in said insulator layer to expose a portion of a top surface of said tri-layer insulator composite (see figure 5); and

removing portion of said tri-layer insulator composite (52) exposed in said opening (see figure 6);

exposing a portion of a top surface of said conductive region (see figure 6).

Regarding to claim 25, the conductive region is a source/drain region in a

semiconductor substrate, or a metal structure such as a metal interconnect structure (38, see figure 6).

Islam teaches forming a tri-layer insulator composite. However, the references does not teach forming the layer silicon rich-silicon oxide layer by using silane and oxygen in LPCVD process, silicon nitride layer by using PECVD or LPCVD process, silicon oxynitrides [SiOxNy(Hz)] by LPCVD or PECVD process and forming the insulator layer by using BPSG layer or silicon oxide layer using TEOS in PECVD or LPCVD process, and etching the layer by using anisotropic etch with an etchant of CHF3, and CF4 or Cl2.

Wolf teaches depositing a silicon nitride or doped silicon oxide (BPSG) layer, or silicon oxide using TEOS, and depositing silicon-rich oxide using silane or disilane and oxygen or nitrous oxide as reactant, silicon oxynitrides [SiOxNy(Hz)] by LPCVD or PECVD process (see table 4, pages 194-195, of Wolf). Wolf also teaches etching the silicon oxide layer and silicon nitride layer by using CF4, CHF3 (see page 581, table 5), vertically/directional etch called anisotropic etch (see pages 551-552).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to deposit a silicon nitride or doped silicon oxide (BPSG) layer, or silicon oxide using TEOS, and depositing silicon-rich oxide using silane or disilane and oxygen or nitrous oxide as reactant by LPCVD or PECVD process, etching the silicon oxide layer and silicon nitride layer by using CF4, CHF3 (see page 581, table 5), vertically/directional etch called anisotropic etch in process of Islam et al. as taught by Wolf et al. because depositing the layers by LPCVD or PECVD process would obtain uniform deposition as well as good step coverage and etching the layers by using CF4 or CHF3 would provide good selectivity and

smaller loading effect.

The specific thickness range of claims 4, 6-9, refractive index, and the time range of claim 11 are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

> Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed Acritical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.
> *In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any thickness range, refractive index, and time range suitable to the method in process of Islam et al. in order to optimize the process.

Allowable Subject Matter

Claims 14-23 are allowed.

Claims 3, 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

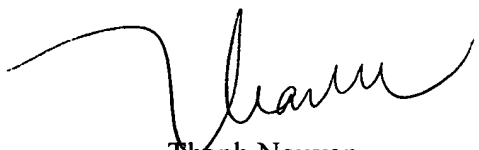
The reason for allowance: none of the prior art alone or in combination teach the subset of forming tri-layer insulator layer is comprised of an underlying silicon rich, silicon oxide layer, a hydro - silicon oxynitride (H0xSiN) layer, and an overlying silicon nitride layer.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).



Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN